KENNECOTT UTAH COPPER CORPORATION
TAILINGS MODERNIZATION PROJECT
INFORMATION SUMMARY

INTRODUCTION

Kennecott Utah Copper Corporation (Kennecott) owns and operates the Bingham Canyon Mine, an open-pit copper mine 30 miles southwest of Salt Lake City. Bingham Canyon Mine is a major global source of copper, with a current annual production of over 250,000 tons. Copper ore from the mine is processed at concentrator, smelter, and refinery facilities located in the foothills of the Oquirrh Mountains. The Kennecott complex is a consolidation of above- and below-ground mining and processing operations that have been worked in this area since the early 1900s.

Kennecott currently manages tailings from copper production in a tailings impoundment located approximately 15 miles west of downtown Salt Lake City (Figure 1). This impoundment has received tailings from past copper production of predecessor mine operations as well as the recently decommissioned Kennecott Arthur Plant. It now receives 153,000 tons per day of tailings from Kennecott's North and Copperton Concentrators. The existing impoundment is bounded by Highway 201 on the south, Highway 202 and a gypsum tailings impoundment on the west, the Union Pacific Railroad (UPRR) tracks on the north, and County Road 8000 West on the east.

HISTORY

Mining and processing copper ore in the Oquirrh Mountains began at the turn of the twentieth century. In 1906, the Bingham Canyon mine became the first successful low-grade, open pit copper mine in the world. The mine, smelter, and existing tailings impoundment facility have been in operation since that time. The Bingham Canyon Mine has yielded more than 12 million tons of copper metal. Approximately two-thirds of Utah's current annual mineral production comes from the Bingham Canyon Mine.

The development of the existing tailings impoundment is closely aligned with the development of mining at the Bingham Canyon Mine. The Magna Mill (now part of the North Concentrator) was originally constructed by the Utah Copper Company in 1906. Initially, the Magna Mill was designed for operation at 3,000 tons of ore per day but was expanded in 1908 to produce 6,000 tons per day (the North Concentrator currently produces 30,000 tons per day). The Mill was located on "Mill Stone Point", which yielded rock suitable for use as mill grinding stones. An additional major consideration in the selection of this mill site was the availability of water from Adamson Springs, located at the toe of this slope, which yielded approximately 6,000 gallons per minute (gpm). The Boston Consolidated Company constructed a mill at Garfield during the period May 1906 to July 1909, which was later to

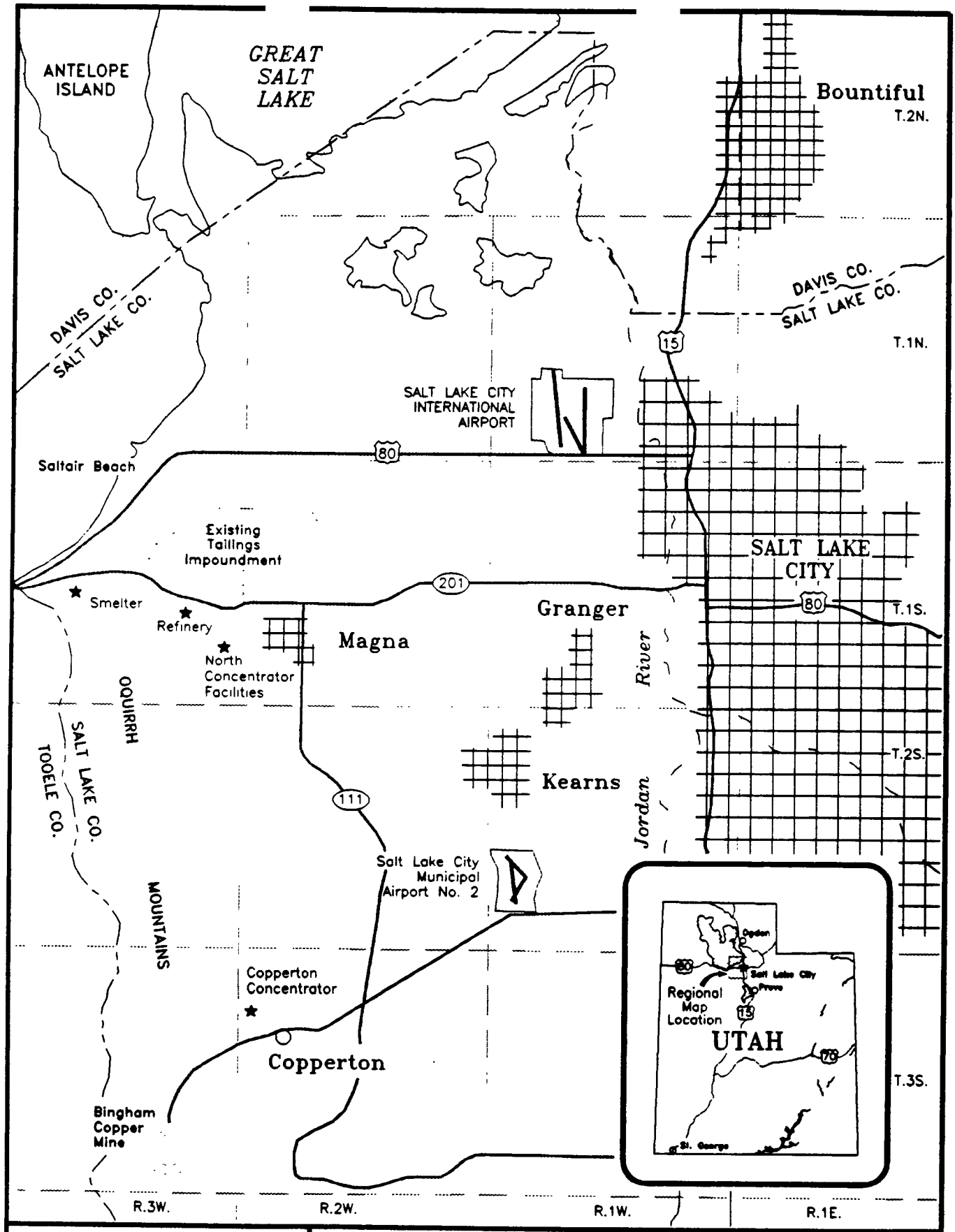


Figure 1 – Project Location and Regional Context

become the Arthur Mill. Water for the Arthur Mill was obtained from Spencer Springs. In 1910, Utah Copper and Boston Consolidated merged.

The original West Pond of the existing impoundment was located below the Arthur Mill and consisted of a 1,350 acre parcel. Waste rock from the Bingham Canyon Mine was used to build a dike which formed the north and east perimeters of the impoundment. The naturally elevated topography contained the tailings on the south and west sides. Photographs indicate that the south boundary sloped moderately northward, and allowed complete gravity discharge of tailings.

Around 1914, the original pond was enlarged by 1,470 acres to include the East Pond, which was located slightly east of the Magna Mill. Originally, a dike was constructed along the north side to contain tailings, which was gradually expanded to include the east and south sides.

In 1916, work was begun to relocate the Western Pacific, Los Angeles, and Salt Lake Railroad Companies' tracks to the north. The work was completed in 1918 allowing for the addition of the North Pond that extended beyond the old railroad grade to the present impoundment configuration.

By 1937, the tailings were approximately 30 feet above original grade on the northwest corner, 20 feet above original grade on the northeast corner, and 17 feet above original grade on the southeast corner. A 1937 photograph shows that the tailings were being contained by a single starter dike and that dike was being constructed by rail haulage along a single track using waste rock from the mine. Each lift was placed slightly inward of the previous lift.

A 1942 photograph of the area below the Arthur Mill indicates that tailings had apparently been excavated and used as construction material elsewhere on the embankment. The history of the existing impoundment's construction after 1945 has been described in the various geotechnical investigations performed since 1950. Most noteworthy are the construction of the second starter dike in 1945, and the use of the present "upstream construction method" (vs. importing borrow materials to construct containment dikes) beginning in 1971.

Today, the impoundment has a total embankment perimeter of 12 miles and covers a total surface area in excess of 5,700 acres. The current average depth of deposited tailings is approximately 190 feet. As the impoundment rises, the active surface area for tailings deposition is reduced because of the impoundment's embankment slope. The present active surface area is approximately 4,100 acres. At the current mill rate of 153,000 tons of tailings per day, the impoundment surface rises at an average rate of approximately 7 to 8 feet per year.

PRESENT OPERATION

To produce copper metal, copper-containing ore is mined and transported to the Copperton and North Concentrators. There, the ore is crushed and ground, and copper minerals are extracted using a flotation process. The resulting concentrate is sent to Kennecott's smelter and refinery

for further processing. Other metals, including gold, silver, and molybdenum, are also recovered.

After the copper and other economic metals are extracted from the ore, the remaining fine grained materials, or tailings, are transported as a slurry to the existing impoundment for storage. Tailings from the Copperton Concentrator are sent via a 48-inch pipeline to a splitter box on the hillside south of Highway 201. At the splitter box, the tailings flow is divided between two 28-inch-diameter pipelines that feed the existing impoundment peripheral discharge system and a 48-inch pipeline known as the Copperton single-point discharge. These pipelines cross the highway on a steel trestle bridge located near the intersection of 9600 West and Highway 201.

Tailings from the North Concentrator cross Highway 201 via a pair of concrete flumes and flow into a pump house. These tailings are then pumped to the top of the embankment and deposited directly into the impoundment through a single-point discharge located approximately 2,000 feet to the east of the Copperton single-point discharge.

The Kennecott Utah Copper Corporation mine, concentrator, smelter, refinery, and tailings operations are designed to operate 24 hours a day, 365 days a year. However, because of maintenance activities, equipment malfunctions and adverse weather, ore processing and tailings production occurs somewhat less than 365 days per year. Normally, two-thirds of the Copperton tailings are sent to the peripheral discharge system, which consists of 39 approximate 1,500-foot pipe sections that distribute tailings sequentially along the entire perimeter of the impoundment and provide effective dust control. The remaining Copperton tailings enter the impoundment through the Copperton single-point discharge. During periods of extreme cold, or operational upset in the peripheral discharge system, the entire Copperton tailings stream can be routed through the Copperton single-point discharge.

After deposition in the impoundment, the solids within the slurry settle and the supernatant water flows to a decant pond in the northeast corner of the impoundment. Three siphons installed in the decant pond transfer the water to the clarification canal, which flows around the southeast corner of the impoundment. This canal provides secondary clarification and returns the water to a primary water pump station, Pump Station No. 1. At the pump station, the water is pumped from the canal to the Magna Reservoir, where the water is returned to the concentrators for reuse in the process water system.

The exterior embankment of the existing impoundment is raised on a continuing basis to accommodate the ongoing tailings management. This is accomplished by excavating previously deposited tailings along the embankment crest and placing the material in an elevated dike around the impoundment perimeter (this is referred to as upstream construction). This operation takes place year-round, curtailed only by severe weather. As the perimeter of the impoundment is raised, the peripheral discharge system and the decant siphons are relocated to allow continued operation on top of the raised perimeter.

NEED FOR PROJECT

In 1985, the mine was closed due to declining world copper prices and Kennecott's relatively high production costs. As a result, thousands of workers were laid off and many remained unemployed for an extended period of time. Modernization and capital improvements, totalling more than $400 million, allowed Kennecott to be more economically competitive and to reopen in 1987. Those improvements were recognized as the first phase of an integrated program that would need to be implemented in order to continue to mine and produce copper in Utah while meeting the demands of an increasingly competitive world copper market, new comprehensive environmental regulations, and Kennecott's responsibilities as a leading member of the greater Utah economic community.

In 1990, as the second phase of the modernization program, Kennecott announced plans to invest an additional $227 million to expand the ore processing capacity at the Copperton Concentrator from 77,000 to 123,000 tons per day. Including production from the North Concentrator, this provided Kennecott with total ore processing capability of slightly greater than 153,000 tons per day. These improvements expanded Kennecott copper metal production to over 250,000 tons per year. The mine has proven ore reserves to support production at these levels for approximately 25 to 30 more years at the current mining rate. In addition to improvements in production, Kennecott initiated other modernization improvements including design and development of new smelter and refinery facilities at a cost of $880 Million. The new smelter will be the cleanest in the world capturing 99.9 percent of the sulfur off gases from the smelting process.

Kennecott initiated studies of the existing tailings impoundment beginning in the mid-1980s in conjunction with its overall facilities modernization studies. The objectives of the tailings impoundment studies were to determine:

(1) if the existing impoundment could provide capacity for tailings storage for the life of the mine; and

(2) if the impoundment satisfies engineering standards consistent with an improved contemporary understanding of the seismic characteristics of the Salt Lake Valley.

The studies determined that the construction techniques used at the existing impoundment evolved with accepted industry standards for tailings impoundment construction and management over the last 87 years. However, given the techniques used in the past for construction, combined with a better understanding of geotechnical and seismological site conditions and the engineering limitations for tailings management, the existing impoundment needed to be upgraded in order to address current engineering standards and increase its operational storage capacity.

The current understanding of impoundment construction and seismic characterization of the Salt Lake Valley recognizes a potential for dynamic failure of the existing impoundment in the event of a large earthquake. This is due to the relatively thin supporting embankment on the north and east sides and the highly saturated, fine-grained nature of the tailings that have been consistently

deposited in these areas. This potential for failure and other engineering criteria, such as the rate the impoundment rises from tailings deposition (rate of rise), limit the operational capacity of the impoundment for tailings storage as well. Based on this understanding, key findings and recommendations of the modernization studies are as follows:

- the impoundment has a potential for a dynamic failure in the event of a large earthquake and measures should be taken to improve its seismic stability;

- the amount of tailings discharged around the perimeter of the impoundment should be increased to improve the impoundment integrity;

- the decant pond has limited capacity to store a peak storm event; therefore, the decant pond and siphon decant system should be upgraded to avoid potential flooding damage to the impoundment;

- the ultimate minable ore reserves in Bingham Canyon Mine are approximately 1.9 billion tons which requires expansion and modernization of the existing impoundment or identification of other storage sites; and

- at current rates of production, the capacity and dynamic stability limitations of the existing impoundment must be corrected (by the turn of the century) in order to continue to produce copper at the Bingham Canyon Mine.

In the past several years, Kennecott has completed the following projects related to the need for seismic upgrading of the existing impoundment.

- Installation of wick drains in the northeast corner of the existing impoundment.

- Relocation of the three decant siphons to the south.

- Installation of first phase of the dewatering system in one, 1,500-ft reach of the southeast corner of the existing embankment.

Two projects are currently underway for the seismic upgrading of the existing impoundment. The first project is construction of a series of step-back dikes at the southeastern corner of the existing impoundment. These dikes shift tailings deposition in that corner away from the perimeter of the impoundment. The second project is the next phase of the dewatering program that includes the installation of wick drains and wells in various portions of the impoundment to facilitate drainage and consolidation of the existing impoundment embankment.

PROJECT PURPOSE

In response to the need for facility modernization and the findings of the tailings impoundment studies, Kennecott has identified a three-fold project purpose. That purpose is to:

1. Upgrade the dynamic stability of the existing impoundment in the event of a significant earthquake.

2. Provide storage for 1.9 billion tons of tailings from the anticipated mining of currently known ore reserves for the next 25 to 30 years.

3. Enable Kennecott to continue to operate competitively in the world copper market.

PROPOSED PROJECT

The proposed project would involve the following key components (see Figure 4):

- Relocation of the C-7 Ditch around the embankment footprint. The relocated C-7 Ditch would discharge to the historic Lee Creek channel.

- Realignment of Union Pacific's Railroad mainline tracks around the embankment footprint.

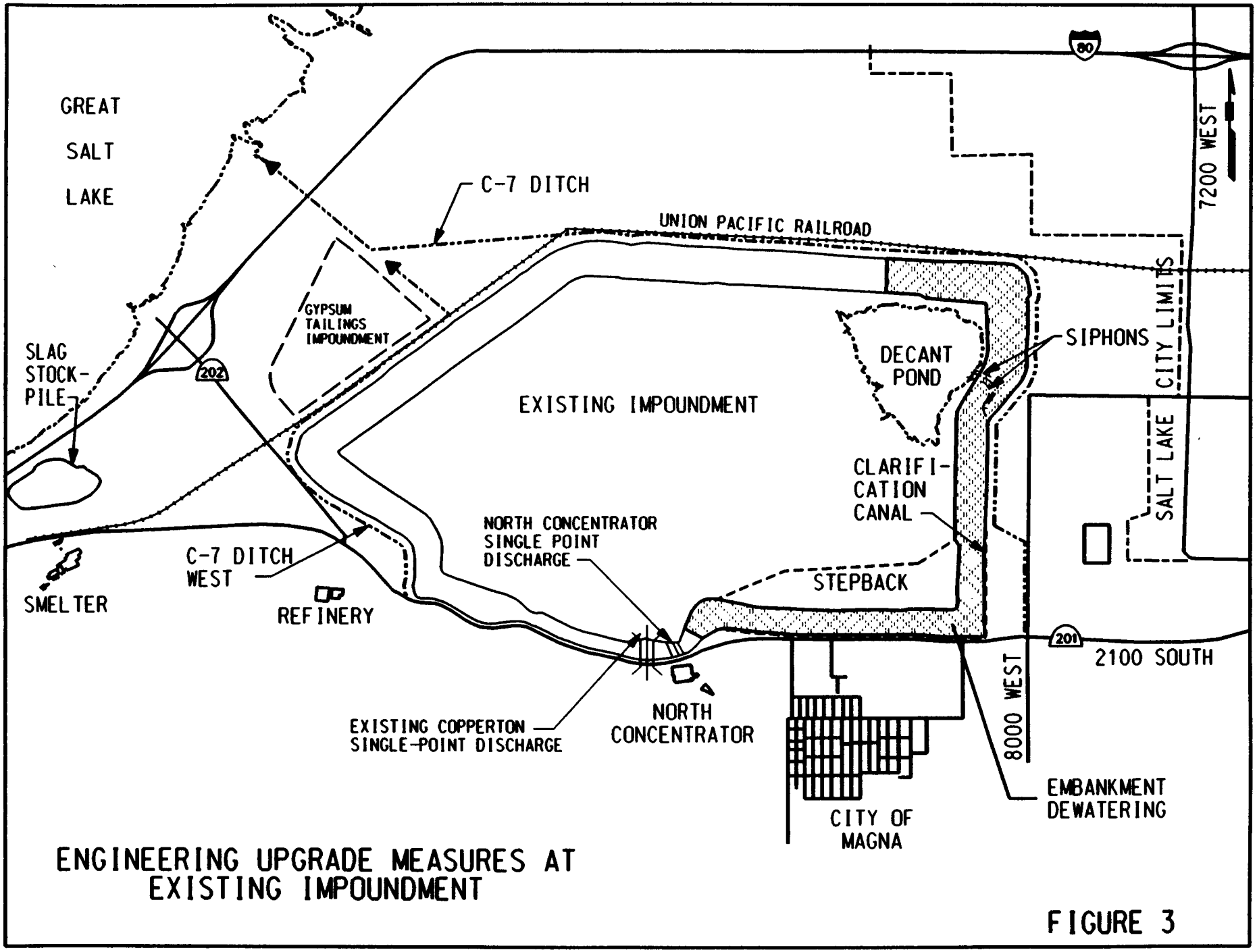
- Foundation preparation and placement of a drainage blanket within the North Impoundment embankment footprint. The starter dike, header dikes, toe ditch and toe dike will be constructed. Starter dike construction material will be supplied by an early cyclone station.

- Construction of cyclone stations near the southeast and southwest corners of the new impoundment.

- Construction of the North Expansion berm, a new stabilization berm approximately 3,700 feet in length, at the northeast corner of the existing impoundment.

- Transition from the existing impoundment to the North Impoundment and revegetation of the existing impoundment.

- Construction of the North Impoundment embankment, concurrently with operational storage of tailings within the impoundment, followed by revegetation of the North Impoundment.



ENGINEERING UPGRADE MEASURES AT
EXISTING IMPOUNDMENT

FIGURE 3

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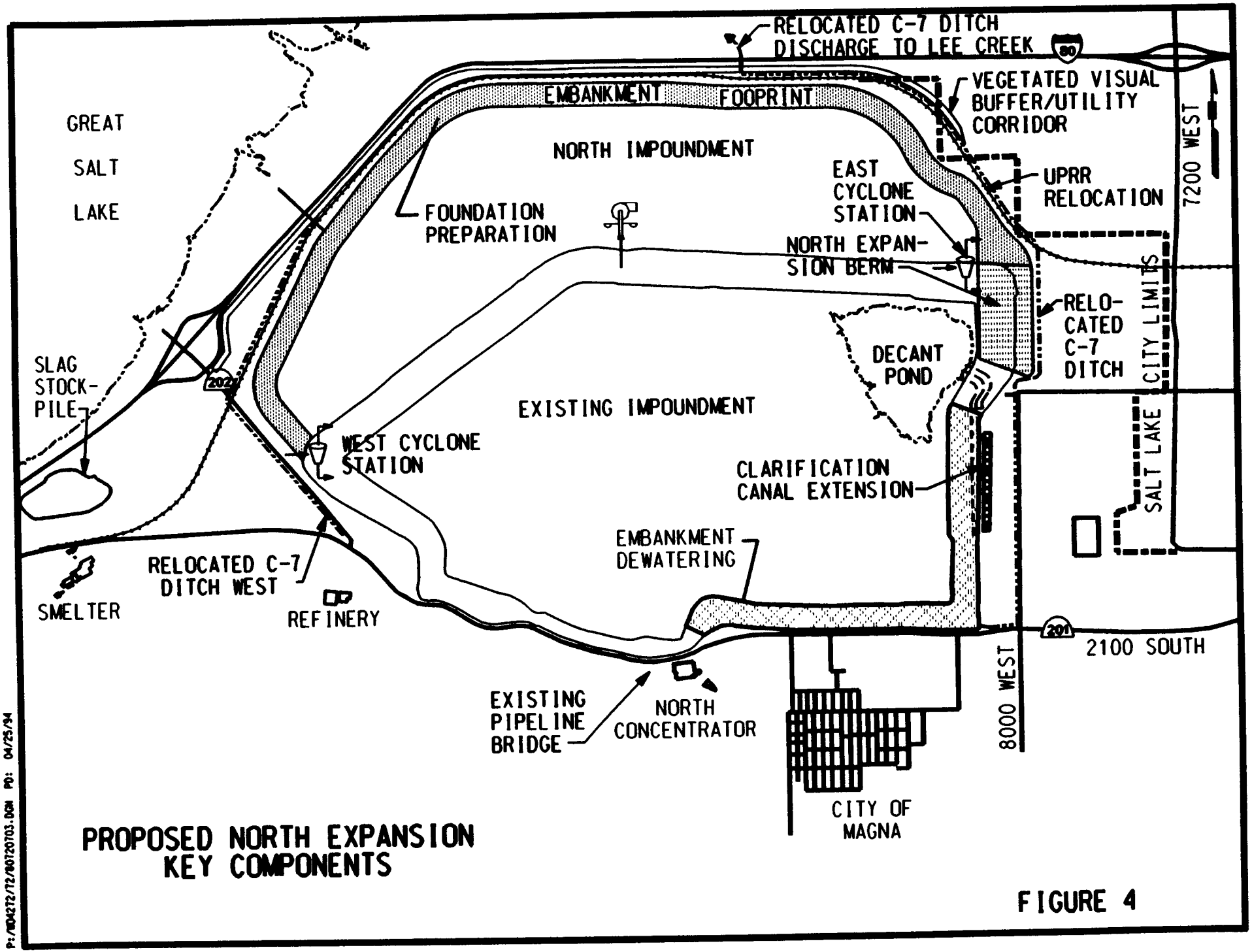
RELOCATED C-7 DITCH DISCHARGE TO LEE CREEK
80
VEGETATED VISUAL BUFFER/UTILITY CORRIDOR
EMBANKMENT FOOTPRINT
GREAT SALT LAKE
NORTH IMPOUNDMENT
EAST CYCLONE STATION
UPRR RELOCATION
7200 WEST
FOUNDATION PREPARATION
NORTH EXPANSION BERM
RELOCATED C-7 DITCH
CITY LIMITS
SLAG STOCKPILE
202
DECANT POND
EXISTING IMPOUNDMENT
WEST CYCLONE STATION
CLARIFICATION CANAL EXTENSION
SALT LAKE
EMBANKMENT DEWATERING
RELOCATED C-7 DITCH WEST
SMELTER
REFINERY
201
2100 SOUTH
EXISTING PIPELINE BRIDGE
NORTH CONCENTRATOR
8000 WEST
CITY OF MAGNA
PROPOSED NORTH EXPANSION KEY COMPONENTS
FIGURE 4
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The tailings from the concentrators will be processed at new cyclone stations to be installed on the existing embankment near the southeast and southwest corners of the North Impoundment. The coarse underflow material, or sand fraction of the tailings, will be used to construct the North Impoundment embankment and North Expansion berm. The overflow material, or slimes, will be commingled with excess whole tailings for deposition into the new impoundment. Deposition will be accomplished through sequential spigotting, which will ensure that the surface of the impoundment is continually wet, precluding the generation of fugitive dust from the tailings impoundment surface.

The North Impoundment embankment will abut the embankment of the existing impoundment at two locations. One is at the northeast corner of the existing impoundment, where the North Expansion berm will be constructed. The other is at the west corner of the existing impoundment. The new impoundment footprint would be approximately 3,300 acres. Before the new embankment is constructed, a drainage blanket will be placed on the foundation to facilitate drainage within the embankment. The blanket will be constructed of processed (crushed and screened) slag materials produced previously by Kennecott smelter operations and now held in stockpiles just north of the smelter and west of the existing impoundment. The new embankment will be built by sequential placement of underflow sand into construction cells and compaction of the sand to the required density. Yearly raises of the embankment are planned to accommodate the volume of tailings to be placed into the impoundment.

A series of corridors along the footprint of the new impoundment will support North Impoundment operations. The corridors will contain Kennecott utilities (which includes a engineered channel along the outside base of the impoundment, commonly referred to as the toe ditch. The toe ditch will collect seepage water from the impoundment and return it to the process circuit), the relocated C-7 Ditch, the realigned Union Pacific Railroad right-of-way, and the relocated Utah Power & Light power lines and the visual buffer corridor. The visual buffer corridor will be revegetated with grasses shrubs, and trees. Access roads will serve the UPRR and UP&L facilities.

ALTERNATIVES CONSIDERED

Several categories of alternatives have been identified and evaluated to address the project purpose and to reduce the potential impacts to jurisdictional waters of the United States. These include seismic upgrade alternatives and tailings storage location alternatives. Seismic upgrade alternative design options include: (1) ground improvement; (2) berm construction: and (3) embankment expansion. Tailing storage improvement alternatives that have been analyzed include on-site and off-site locations. In addition, a combination of on-site and off-site alternative options have been identified and assessed for meeting the project purpose.

The alternative formulation process generally considered the following factors in preliminary project design: the avoidance or minimization of impacts to jurisdictional waters of the U.S.; requirements for the transport and storage of tailings; the dynamic stability of new and existing tailings impoundments; materials used in impoundment construction; tailings and process water pumping and delivery requirements; site foundation requirements; project economics; community effects; and environmental consequences. Previous Kennecott tailings impoundment siting

studies were also combined with current dynamic stability engineering requirements to identify the range of possible alternatives. The different alternative options are briefly described below.

Seismic Upgrade Design Options

Ground Improvement. Ground improvement technology addresses two very different approaches to enhancing the seismic stability of the existing impoundment; ground compaction and material replacement techniques. Initial considerations included compacting key portions of the tailings embankment to a density that is resistant to seismically induced loading or replacing a portion of the embankment with dense, free draining materials that are not susceptible to seismically induced loading. For ground compaction, a densification evaluation indicated that 50 to 75 percent of the tailings are too fine grained to be effectively compacted by these compaction techniques. Additionally, if the tailings could be compacted, the practical depth limit of these techniques is approximately 100 feet. To sufficiently improve stability at the existing impoundment, compaction to depths greater than 100 feet are required. For all of these reasons, compaction was eliminated from further consideration as a seismic upgrade design option.

Material (structural tailings in the embankment) replacement techniques evaluated included construction of stone columns and jet grouting/tailings mixing. Stone columns would improve the tailings structure locally, but would not provide improvement between columns and could be subject to infiltration from adjacent tailings during a significant seismic event. Jet grouting/tailings mixing produces discrete columns of strengthened material, but does not improve the area between columns. Overlapping columns were considered, but these could act as an impervious cutoff, adversely affecting the portions of the embankment behind the stabilized zone by impeding the movement and drainage of water. Replacement techniques were not considered feasible for these reasons and were not studied further.

Berm Construction. This option would stabilize the embankment by placing a mass of secure, compacted fill to act as a buttress along portions of the embankment. Engineering studies have shown that a berm width of approximately 1,100 feet would be required along the north and northeast sides to achieve the requisite seismic upgrade for the existing embankment. This construction would require an estimated 112 million cubic yards of material. The existing dewatering and stepback dike program in the south and southeast corner of the impoundment would need to be continued as a part of any berm construction program to maintain the impoundment's seismic upgrade.

Fill materials considered for berm construction include mine waste rock, site borrow, or cycloned tailings sand. *Cyclone* refers to the mechanical process of separating slurried tailings into underflows [the coarser sand fraction] and overflows [the finer-grained materials]. Waste rock is not economically feasible material because it would need to be processed and hauled 15 miles from Bingham Canyon Mine, then placed and compacted. Site borrow is not feasible because there are no suitable sites for the excavation of 112 million cubic yards of structurally suitable soils and gravels. Of these materials, only cycloned tailings sand could technically, and economically be placed.

The use of the cycloned tailings strictly for berm construction at the existing impoundment would result in production of large quantities of fine tailings that would require an impoundment for storage. Those fine tailings would require a berm to contain them. The berm would require additional cycloned tailings. It is estimated that the total of cycloned sands available at current production over an eight year period would be required to upgrade the existing impoundment. During this period, over 280 million cubic yards of non-structural fine grained tailings would also be produced. To store the fine grained tailings, an additional 112 million cubic yards of cycloned sands would be required. This approach would result in approximately a fifty percent (50 %) shortfall in cycloned sands. However, there would not be sufficient cycloned tailings to contain the fine tailings produced and to construct a berm at the existing impoundment.

Embankment Expansion. This option would consist of constructing a new embankment engineered to withstand a significant earthquake and would provide additional tailings storage. Placement of the new embankment would be at a sufficient distance from the existing embankment to provide tailings storage in the intervening space.

Tailings Storage Improvement Options - Onsite Alternatives

On-site Alternative 1 - Continue Raising Existing Impoundment "No Action" (Figure 5). This alternative would avoid direct impacts to jurisdictional waters of the U.S. However, impoundment failure resulting from a major seismic event could result in an impact to jurisdictional waters of the U.S. and surrounding facilities and development. This alternative would not provide tailings storage for continued mining operations resulting in cessation of tailings storage operations on the existing impoundment by the end of the century.

On-site Alternative 2 - Continue Raising Existing Impoundment, Construct Berm Around Impoundment (Figure 6). In this alternative, the existing embankment would be seismically upgraded by constructing a berm around most of the impoundment and continuing to raise the existing impoundment. The berm would not be placed along the western half of the south side of the existing impoundment because of the low phreatic levels within this reach and the existing natural topography. The berm would be constructed of compacted, hydraulically-placed cycloned tailings sand, which may be available in a quantity up to 30 percent of the total tailings flow. This alternative would entail creating a complete structural berm up to the full height of the impoundment. If sufficient cycloned tailings were available, an impoundment height of approximately 365 feet, would be required to store approximately 1.4 billion tons of tailings. For an impoundment height of 365 feet, the structural berm would have to be a greater than 1,200 feet wide. In order to store 1.9 million tons of tailings, an impoundment height of greater than 450 feet would be required. The berm footprint at 1,200 feet wide would occupy approximately 1,196 acres of land. Construction would require major facilities relocation,

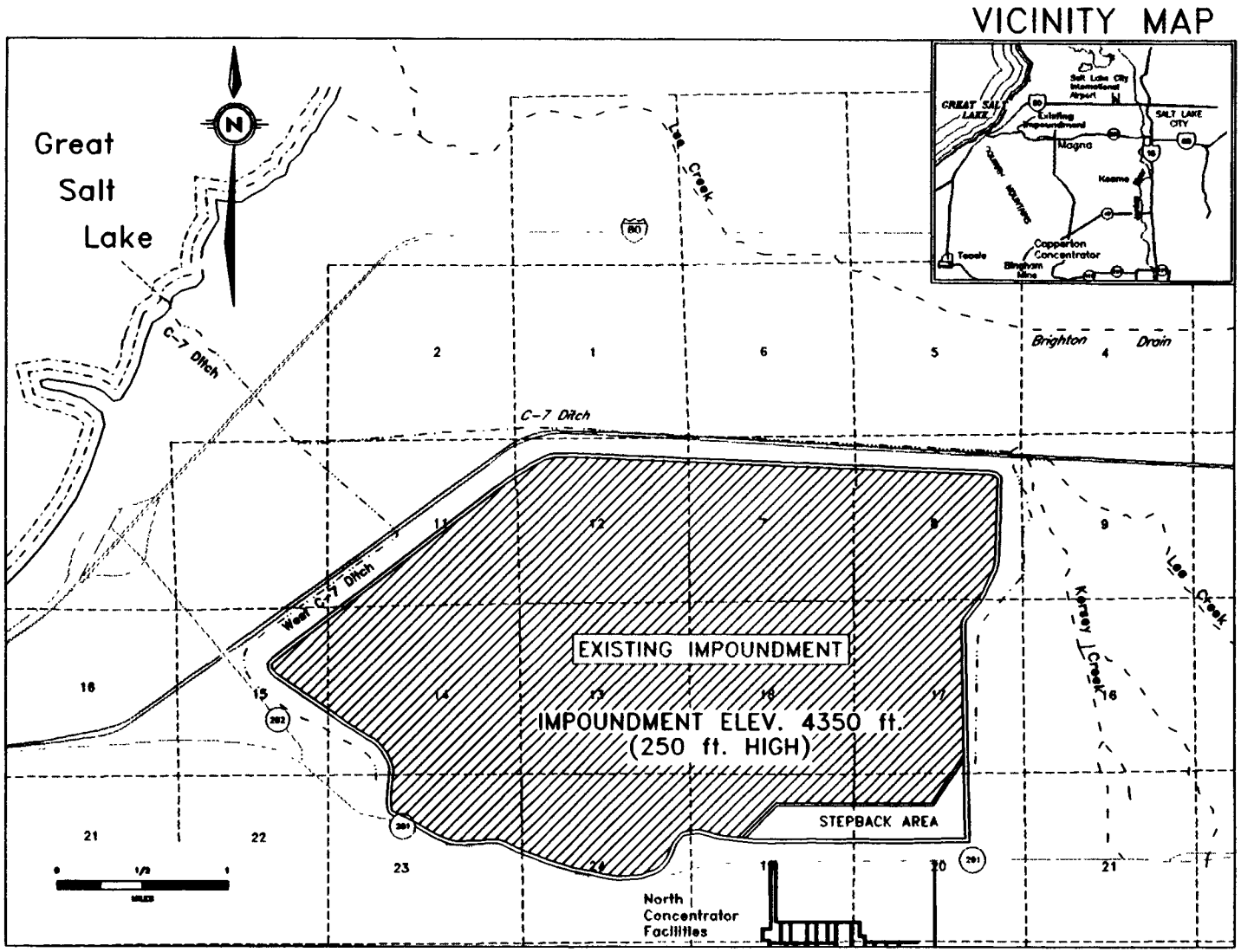

FIGURE 5 ON-SITE ALTERNATIVE 1: Continue Raising
Existing Impoundment "No Action"
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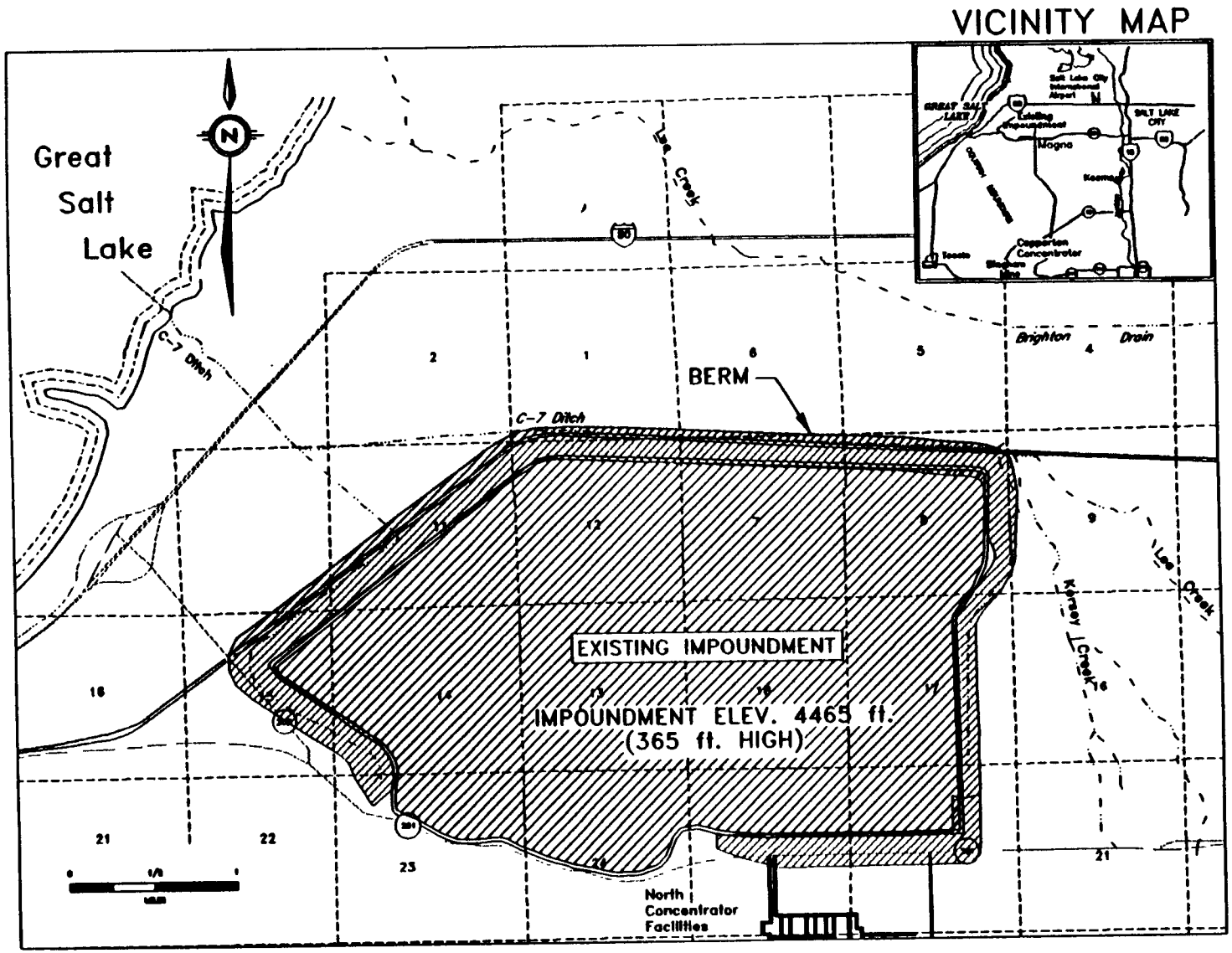

FIGURE 6 ON-SITE ALTERNATIVE 2: Continue Raising Existing Impoundment, Construct Berm Around Impoundment

including the double-tracked Union Pacific Railroad to the north, State Highway 201 at the southeast corner, and major buried utilities.

On-site Alternative 3 - Implement North Expansion (East) Along With Upgrading Other Reaches of Impoundment (Figure 7). In this alternative, the existing impoundment would be raised to a final height of approximately 250 feet, providing an additional 300 to 400 million tons capacity from present. The remaining 1.5 to 1.6 billion tons would be placed in the north expansion area, immediately adjacent to the existing impoundment, bringing the new embankment to a final height of approximately 250 feet, roughly equal to the estimated final height of the existing impoundment under this alternative.

The expansion would be constructed as a centerline embankment of compacted, hydraulically-placed cycloned tailings sand. The embankment is designed for a final height of approximately 250 feet with an embankment width of 1,125 feet. The total North Expansion (East) tailings impoundment footprint would be approximately 4,100 acres. Property affected by this alternative would include industrial salt evaporator impoundments, drainage ditches, roads, railroad tracks, and undeveloped areas. Relocation of the Union Pacific Railroad tracks, a number of drainage channels, and various utilities would be necessary.

Additional seismic upgrade measures optimizing embankment dewatering would be applied along the east side and the southeast corners. With the existing impoundment's height limited to approximately 250 feet, dewatering is anticipated to satisfy seismic upgrade requirements needs for these portions of the embankment.

Previous geotechnical site investigations indicate that the expansion site is highly suited for embankment construction and tailings storage. The investigations identified a 9 to 15 foot thick strata of a low permeable clay (the Bonneville stratum with permeability of 10^{-7} to 10^{-9} cm/sec), overlying a 25 to 35 foot thick stratum of low permeability, interbedded clays, silts, and sands (identified as the Cutler Dam stratum with permeability of 10^{-5} to 10^{-7} cm/sec).

On-site Alternative 4 - Implement Reduced North Expansion Along With Upgrading Other Reaches of Impoundment (Figure 8). This alternative involves implementing the main features of On-site Alternative 3 (North Expansion [East]) with a reduced surface area in the northeast corner to minimize impacts to jurisdictional waters of the U.S. (saline playas). This would reduce the total footprint to approximately 3,200. Like the North Expansion (East) alternative, 300 to 400 million tons of tailings would be stored in the existing impoundment, with the remaining 1.5 to 1.6 billion tons stored in the expansion area.

To compensate for the reduced impoundment area, the total height of the expansion embankment would have to be increased to approximately 350 feet to accommodate 1.6 billion tons of tailings. The increased height would require constructing an additional embankment on top of

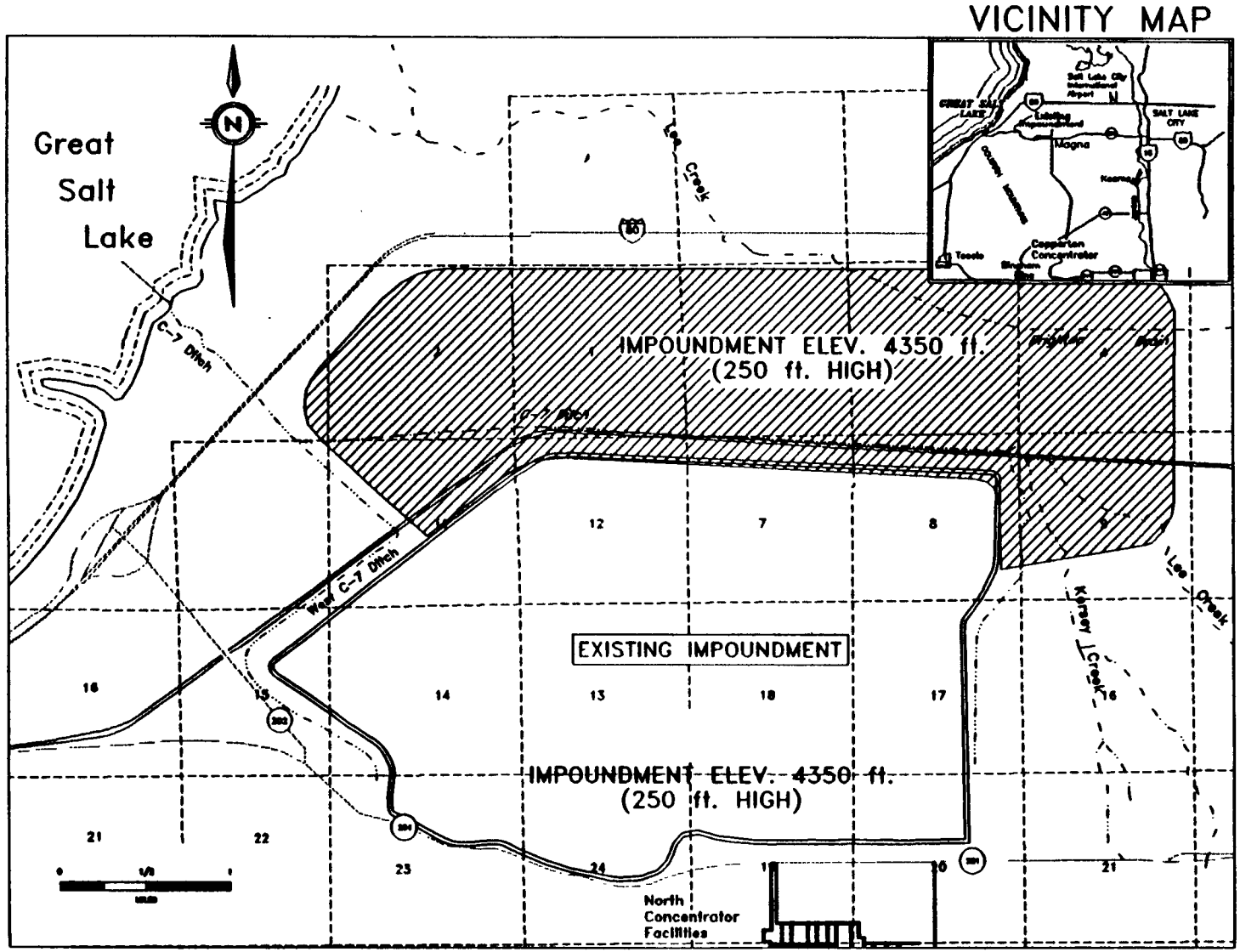

FIGURE 7 ON-SITE ALTERNATIVE 3: Implement North Expansion (East) Along With Upgrading Other Reaches of Existing Impoundment

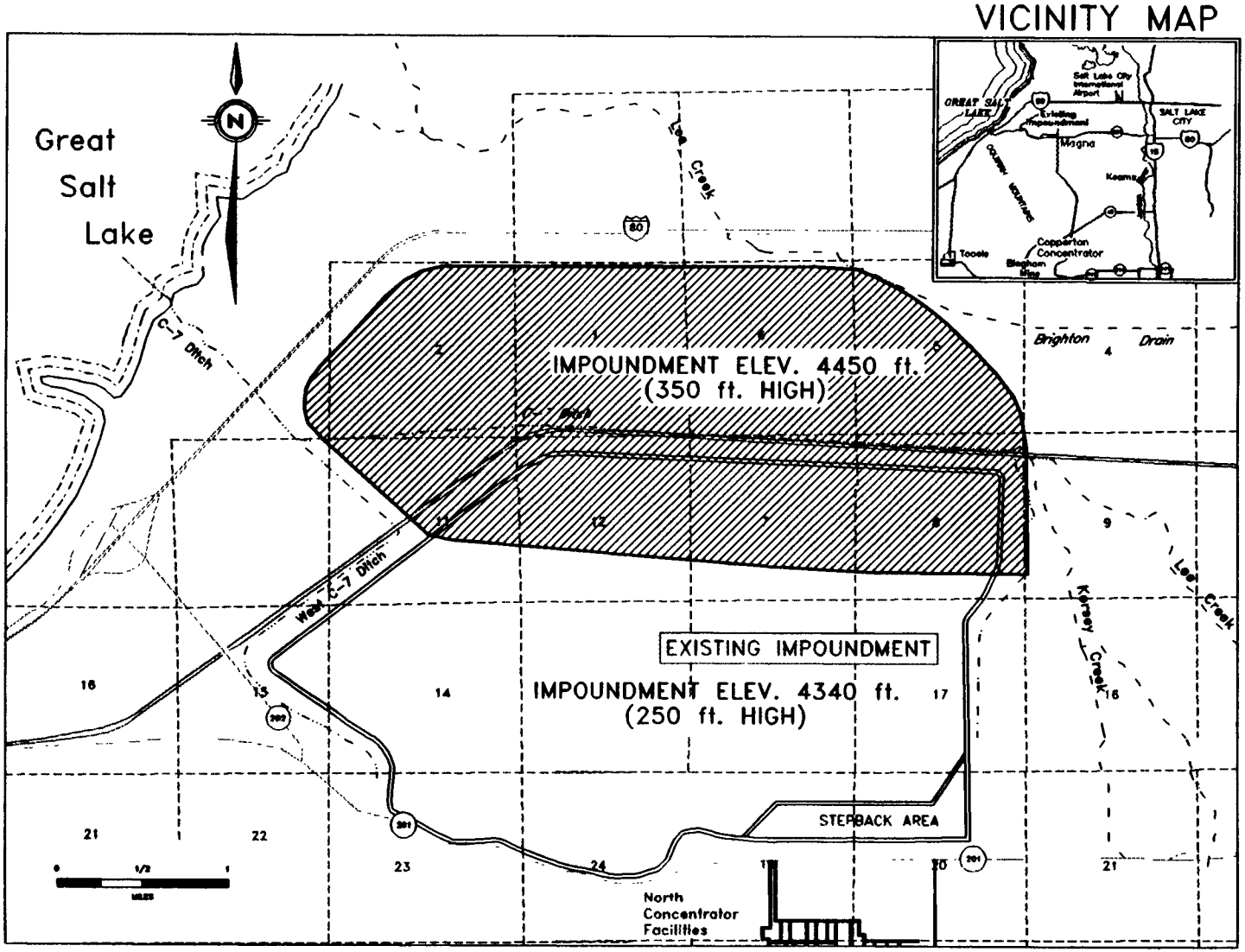

FIGURE 8 ON-SITE ALTERNATIVE 4: Implement Reduced North Expansion Along With Upgrading Other Reaches of Existing Impoundment

the northern part of the existing impoundment. This embankment would have to be constructed on top of the very weak fine tailings deposited within the present impoundment. A geotechnical review of this option showed that these soft materials, particularly in the area of the present decant pond in the northeast corner, would not provide an adequate foundation for embankment construction.

On-site Alternative 5 - Implement Reduced North Expansion (West) Along With Upgrading Other Reaches of Impoundment (Figure 9). This alternative would provide the full projected tailing volume of 1.9 billion tons, utilizing the area immediately to the north and northwest of the existing impoundment. Under this alternative, 300 to 400 million tons of tailings would be placed onto the existing impoundment, bringing its height to approximately 250 feet above the existing ground surface. The remaining 1.5 to 1.6 billion tons of tailings would be placed in the approximately 3,300 acres in the North Expansion (West) area.

Current planning is for the construction of an approximate 190 foot high embankment to store tailings produced through 2018. To store the remaining 0.5 billion tons of tailings, the new embankment will be raised to an elevation of approximately 250 feet (predicated on settlement) above the existing ground surface. This would be accomplished by a geotechnical evaluation of the embankment for final engineering design to combine raising the North Expansion Project and portions of the existing impoundment up to a height of approximately 260 feet. The expansion would be constructed similar to North Expansion (East). In addition, the alternative would include similar dewatering measures as described for North Expansion (East).

Site investigations indicate the presence of a 9 to 15 feet thick low permeable clay overlying a 25 to 30 foot low permeability layer of clay with interbedded silts and sands. Property affected by the North Expansion (West) includes salt evaporator impoundments, phosphogypsum tailings and processing facilities, drainage ditches, and railroad tracks. Over ninety percent (90 %) of the land affected by this alternative has been heavily influenced by human activities.

Tailings Storage Improvement Options - On-site/Off-site

The following section describe the on-site/off-site tailings storage alternatives. Of the six off-site storage alternatives, only three sites could provide the total capacity requirement. In order to develop more alternatives, two of the other three sites were combined to provide the required capacity, for a total of five "on-site/off-site" alternatives. The on-site/off-site alternatives include the following (see Figure 10 for location of off-site alternatives):

- On-site/Off-site Alternative 1 - Barneys Canyon
- On-site/Off-site Alternative 2 - Coon Canyon
- On-site/Off-site Alternative 3 - Dry Fork-Carr Fork
- On-site/Off-site Alternative 4 - Tooele-Carr Fork
- On-site/Off-site Alternative 5 - Stockton

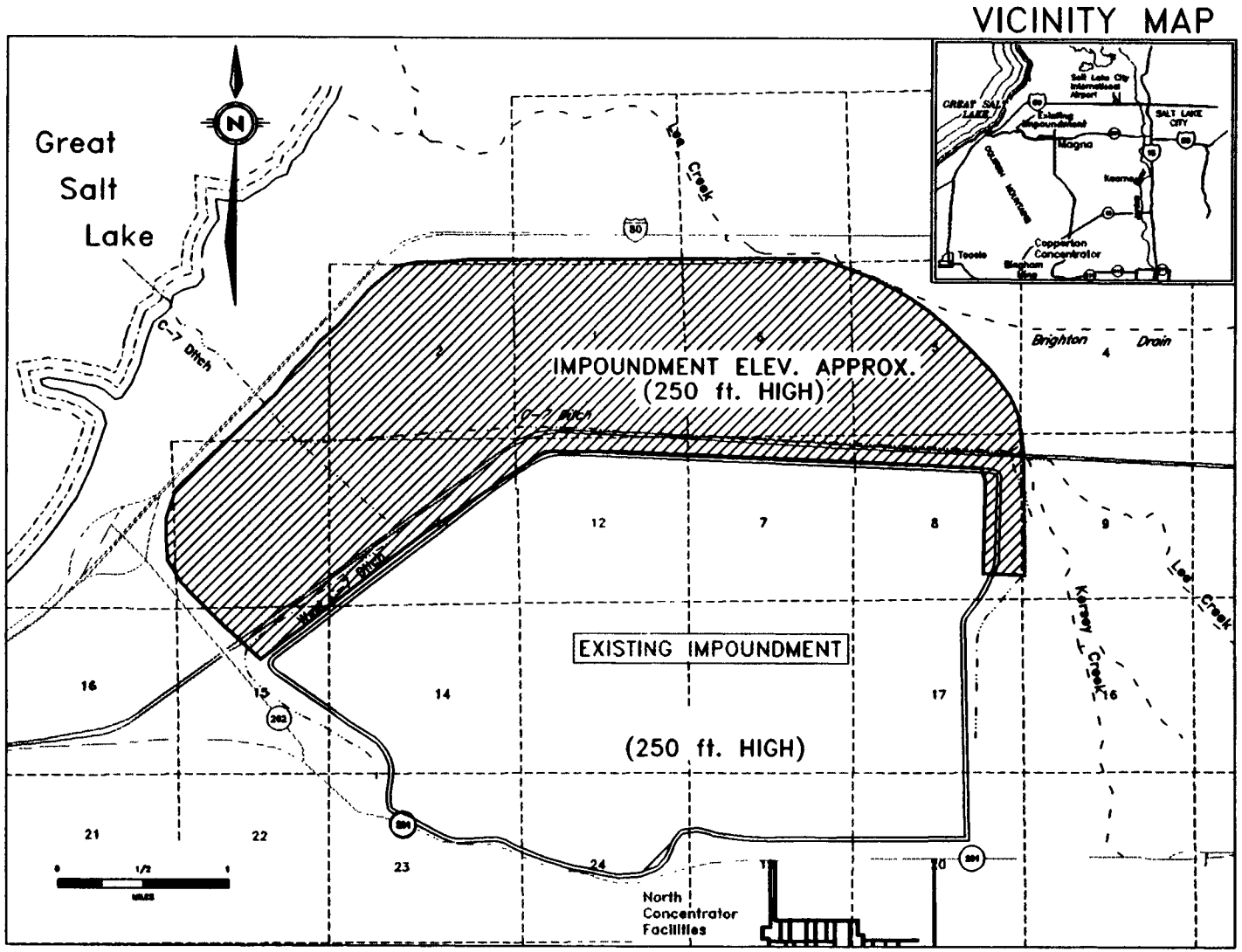

FIGURE 9 ON-SITE ALTERNATIVE 5: Implement North Expansion (West) Along With Upgrading Other Reaches of Existing Impoundment

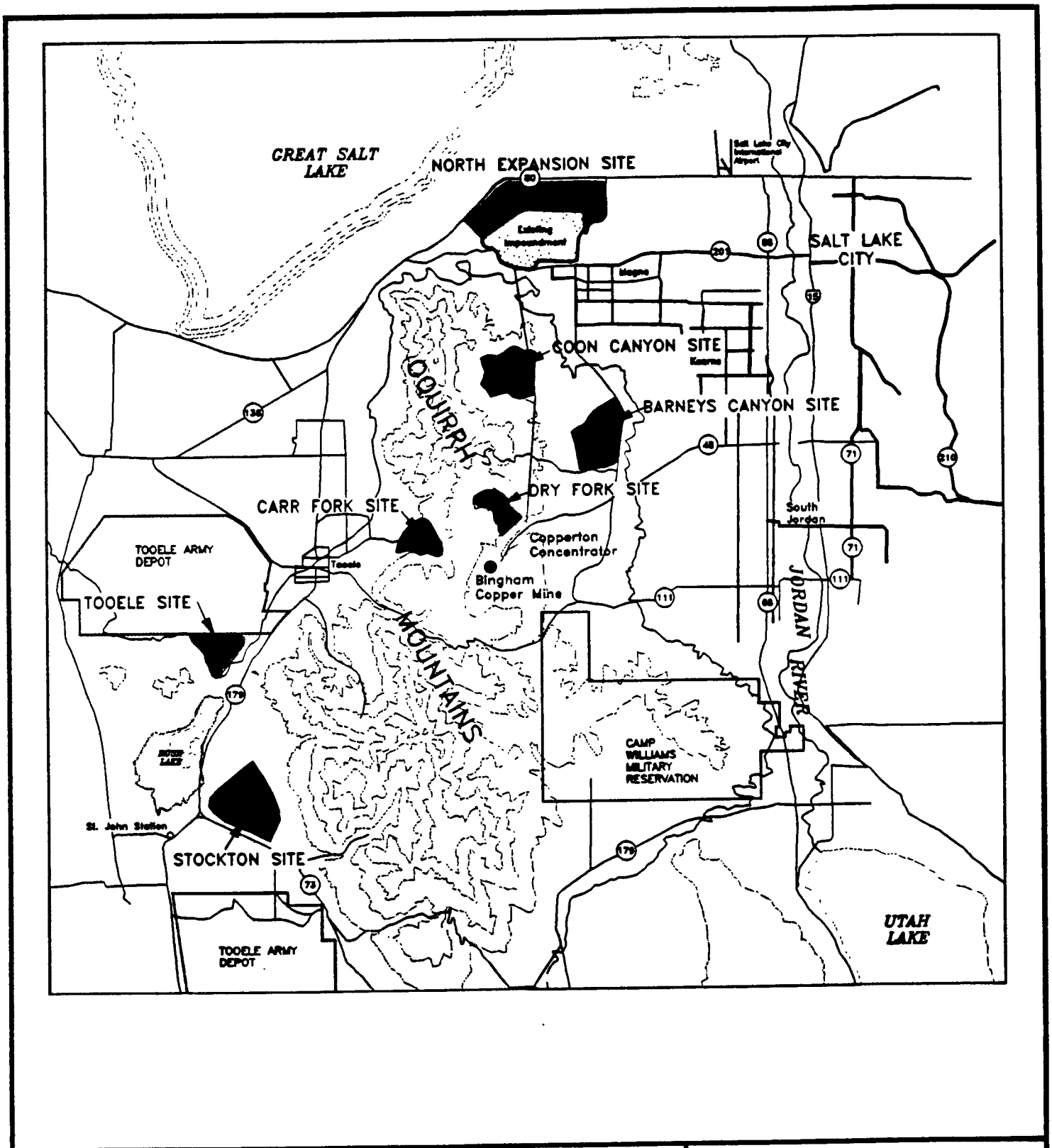

Figure 10 Alternative Tailings Storage Location

Each of the alternatives involves use of an off-site impoundment to store up to 1.6 billion tons of tailings, in addition to the 300 to 400 million tons that would be stored in the existing impoundment. As previously discussed, in order to achieve the Project purpose, each of the off-site alternatives would require a separate, logistically integrated project to seismically upgrade the existing impoundment. This seismic upgrade would be the construction of the hydraulically-placed cycloned tailings berm around the north, northwest, and northeast corners of the existing impoundment.

On-site/Off-Site Alternative 1 - Barneys Canyon. The Barneys Canyon site is in the foothills on the east flank of the Oquirrh Mountains. The site is bounded by State Highway 111 on the east, Barneys Canyon on the south and Harkers Canyon on the north. This site occupies two distinct watersheds, Clay Hollow and Barneys Canyon. The Barneys Canyon site is located near the Copperton Concentrator. With a one mile extension, the existing gravity-fed pipeline from the Copperton Concentrator would be used for delivery of tailings to the site. However, tailings would need to be pumped uphill, approximately eight miles south from the North Concentrator to the site.

To develop storage for 1.6 billion tons, a centerline configuration embankment would be constructed of cycloned tailings to a height of approximately 530 feet. The prefeasibility level designs indicated a 230 feet high starter dam would be constructed of mine waste rock, with ongoing cycloned sand construction. The impoundment would cover an area of approximately 4,800 acres. The height of the Barneys Canyon embankment necessitates a volume of cycloned tailings which conflicts with that required for seismic upgrading at the existing impoundment. Insufficient cycloned tailings would be available for both embankment construction and seismic upgrading at the existing impoundment.

The Barneys Canyon site is located over a deep, unconsolidated alluvial deposit more than 400 feet thick, which consists of variable, unconsolidated soils that may be subject to collapse (extreme consolidation) if wetted while under a load. The site is an area of groundwater recharge, connecting to a major Class 2 Aquifer that is used as a municipal water supply for the west valley. The water table lies at a depth of 300 to 400 feet below the ground surface. Because of this sensitive aquifer, a double geomembrane/clay liner would be proposed for the site, with drainage placed at the base of the tailings to reduce gradients above the liner.

On-site/Off-Site Alternative 2 - Coon Canyon. The Coon Canyon alternative is located on the east side of the Oquirrh Mountains, approximately eight miles from the Copperton Concentrator. The impoundment would be located in the upper reaches of Coon Canyon, between the ridges of Harkers Canyon and Little Valley Wash. Presently, the land is relatively undisturbed. Similar to the Barneys Canyon site, Coon Canyon lies over unstable foundation soils. In addition, it is located in the watershed above a recharge area for an aquifer used for municipal water supplies.

Additional, there is no on-site source of fill material, which exacerbates conflict over materials required for both dam construction and seismic upgrade of the existing impoundment to impound 1.6 billion tons of tailings at this site would require construction of a 1,200-feet-high, centerline configuration cycloned sand dam, with a 500-feet-high starter dam. Tailings would be pumped from both Copperton and North Concentrators, with a lift of up to

1,000 feet from Copperton and over 1,200 feet from the North Concentrator. Two parallel pipelines, each 7.5 miles long, would be constructed from the Copperton Concentrator. An emergency retention pond would be required to impound tailings backflow in the event of pumping or power failures. A double geomembrane/clay liner would be required, with drainage placed at the base of the tailings to reduce gradients above the liner.

On-site/Off-Site Alternative 3 - Dry Fork-Carr Fork. This alternative proposes use of two tailings storage sites, one on the existing Dry Fork waste rock dump above Bingham Canyon, and the other at Carr Fork on the west side of the Oquirrh Mountains. This alternative has a combined total storage capacity of 1.5 billion tons: Dry Fork has a storage capacity of approximately 700 million tons and Carr Fork has an approximately 800 million ton capacity. After the Dry Fork impoundment has reached capacity, tailings would be stored at the Carr Fork site.

The Dry Fork tailings dam height would be 600 feet built upon a 600 foot deep existing waste rock dump. Waste rock from the leach dump would be reworked to build the starter dam. After construction of the starter dam, the embankment would be constructed with cycloned, compacted tailings, placed on the existing leach dump. To prevent piping[1] of tailings through the leach dump rockfill, a high density polyethylene (HDPE) pipe drain would be installed beneath the tailings impoundment.

The tailings pipeline that would be constructed from the Copperton Concentrator to the Dry Fork impoundment would be approximately 4.5 miles long with an initial slurry lift of 1,000 feet and a maximum lift of 1,600 feet. Booster pump stations would be required to provide the lift from the Copperton and North Concentrators. An emergency retention pond would be needed to receive tailings backflow during maintenance or in the event of a power failure.

Upon reaching capacity at Dry Fork, the existing Parvenu tunnel would be used to transport tailings to the Carr Fork site. A gravity pipeline would lead from the tunnel to the tailings impoundment. The ultimate dam height at Carr Fork would be 450 feet. The volume of material required to construct both impoundments conflicts with that required for a seismic upgrade at the existing impoundment.

On-site/Off-Site Alternative 4 - Tooele-Carr Fork. This alternative consists of storage at two separate impoundments, one located three miles south of the town of Tooele on the west side of the Oquirrh Mountains and the second located at the Carr Fork site described under the Dry Fork-Carr Fork alternative. The Tooele site is located at the south boundary of the Tooele Army Depot in the uppermost reaches of the Tooele Valley overlying an aquifer recharge area. For this alternative, 300 million tons of tailings would be stored at the existing tailings impoundment and 800 million tons stored at each of the Tooele and Carr Fork sites.

At Tooele, the ultimate dam height would be 430 feet. Tailings would be pumped to a height of 280 feet to a concrete launder inside a 5.7 mile long tunnel through the Oquirrh Mountains to the Carr Fork site, then would be transferred to an at-grade concrete launder and transported

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[1] Piping is the result of uncontrolled seepage in tailings dams and embankments. Piping can lead to external erosion, progressive tunneling, and subsequent collapse of an embankment or dam.

to the Tooele site. Trestle crossings would be required at Settlement Canyon and State Highway 36. Upon reaching capacity at Tooele, tailings would be stored at Carr Fork. It is anticipated that this site would require installation of an impervious liner and sub-drainage system comparable in scope to the Barneys Canyon Alternative. The construction of two impoundments results in a material imbalance of cycloned tailings to allow for a seismic upgrade of the existing impoundment.

On-site/Off-Site Alternative 5 - Stockton. The Stockton alternative consists of establishing an impoundment on low lying foothills west of the Oquirrh Mountains, six miles south of the town of Stockton in Rush Valley. The site is located at the junction of State Highways 36 and 73 on public land managed by the BLM, approximately 2 miles above Rush Lake.

The tailings storage would consist of a series of pump stations, pressurized pipelines, and a concrete launder. The tailings lift from Copperton would be 645 feet to a 4.7 mile long tunnel through the Oquirrh Mountains. Beyond the tunnel would be a 16.2 mile long gravity pipeline to the disposal site. The pipeline would require construction of trestle crossings at Pine Canyon and Settlement Canyon. A double liner would be required for aquifer protection purposes. Furthermore, as with the other off-site alternatives, this option does not meet material balance needs with the parallel upgrading requirements of the existing impoundment.

EXISTING DATA FOR PROJECT STUDY AREA

- DELINEATION OF POSSIBLE JURISDICTIONAL WATERS OF THE U.S.
- BIOLOGICAL RESOURCES
  - VEGETATION
  - WILDLIFE
  - AQUATIC RESOURCES
- SURFACE WATER QUALITY
- GROUNDWATER QUALITY
- GEOLOGY, SOILS AND SEISMIC
- CULTURAL RESOURCES
- REGIONAL SOCIO-ECONOMICS
- OTHER INFORMATION